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Agronomic diversity among rice (*Oryza sativa* L.) lines in a germplasm collection in Greece

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Abstract: Field experiments were carried out in order to study the diversity in morphophysiological characteristics of rice genetic material preserved in collections of five rice producing countries of the European Union. A total of 334 lines was studied in the years 1996, 1997 and 1998. The experiments were carried out at the farm of the Cereal Institute at Kalochoi-Thessaloniki, Greece. Each line was sown in a single plot that were 3 m long and consisted of 3 rows, 0.25 m apart.

The time to heading ranged from 60 to 142d and the time to maturity from 109d to 170d. Most of the lines were resistant to lodging and to shattering. Very useful genetic material was found for the characteristic "panicle leaf habit". All the lines were interesting as for the characteristic "panicle type". Great variability was shown for "panicle length" and "plant height" that ranged from 10 to 27 cm and from 57 to 155 cm, respectively. Most of the lines tested showed well-exserted panicle. The glumes were less than grain in all lines. The majority of the lines did not have apiculus color. Differences among lines was observed for the characteristic "hull pubescence", but the majority of them (57% in 1996, 79% in 1997 and 71% in 1998) had intermediate hull pubescence. There was less variability for the characteristic "awnings". Results indicate that the genetic material studied had great variability that could be exploited in the breeding programmes.

Introduction

Rice (*Oryza sativa* L.) is cultivated in a wide range of ecological environments worldwide. Two major subspecies of rice, *indica* and *japonica*, have been widely recognized (Oka 1988). They differ in many characteristics of agronomic importance including seed weight, time required for seed germination and time from heading to maturity (Oka and Morishima 1982), leaf form and colour, angle of boot leaf with stem, awns, hull pubescence (Kato 1930) and cold tolerance (Khan et al. 1986). These differences reflect a varying behavior of rice plants in the field that is necessary to be taken into account by growers in order to optimize the rice yield and quality. For example, recent research in Greece has shown that the delayed establishment of Indica type varieties in the field favored the rapid barnyardgrass (*Echinochloa crus galli*) growth at the early stages and resulted in lower effectiveness of herbicide propanil, compared to Japonica type varieties (Ntanos and Koutroubas 2000a). Also the infestation of the rice plants by the pink stem borer (*Sesamia nonagrioides* Lefebvre), under natural infestation conditions, was found to be positively correlated with days to heading, plant height and stem diameter (Ntanos and Koutroubas 2000b).

Evaluation of genetic diversity is a prerequisite for successful germplasm exploitation through breeding. The objective of this study was to investigate morphological and agronomic variability among rice lines from collections maintained in five European countries.

I – Materials and methods

The experiments were carried out at the farm of the Cereal Institute of Thessaloniki (40°33'N 23°00'E), Greece, in 1996, 1997 and 1998. The soil was a silty loam (Aquic Xerofluvents) with a pH of 7.5 and 1.6% organic matter. A total of 334 lines were tested in the field for agrophysiological characteristics (Table 1). The lines belonged to both Indica and Japonica types and were maintained in collections in five European countries (France, Greece, Italy, Portugal and Spain). Since the field screening of a large number of lines for three consecutive years is a difficult procedure, 79 lines were tested in 1996, 176 in 1997 and 72 in

1998. Seven varieties (Baldo 363, Koral, Ariete, Loto, Senia, Thaibonnet, and Cigalon) were common in all years and were used as controls for comparison among years. These varieties are widely grown in the Mediterranean countries and differ in many agronomic and morphological characteristics. The control varieties were chosen to cover a wide range of maturity time. Cigalon and Loto are very early-maturing, Baldo 363, Koral, and Ariete are early, Senia is mid-season and Thaibonnet is late-maturing variety. Each line was sown in a single plot that were 3 m long and consisted of 3 rows, 0.25 m apart.

Standard water management practices used in Greece were applied. The field was flooded two days before sowing and maintained about 10 cm deep until ten days before harvest, except for two days in which the herbicide propanil was applied. Sowing was on May 24, 1996, May 26, 1997 and May 25, 1998 by hand broadcasting, at approximately 5 g of seed per row. Seeds had been soaked in water for 24 hours before sowing. The field was fertilized with 150 kg N ha⁻¹ in three increments, 33 kg P ha⁻¹ and 62 kg K ha⁻¹, applied by hand broadcasting. The first 55 kg ha⁻¹ increment of N and the whole amount of phosphorus and potassium were applied before sowing. The second 60 kg ha⁻¹ increment of N was applied when rice was at the tillering stage and the third 35 kg ha⁻¹ increment prior to the panicle initiation. Two herbicide treatments were carried out against weeds. Molinate 3600 g.a.i./ha against *Echinochloa crus galli* at the 2-leaves stage of this weed. Also a mixture of 3600 g.a.i./ha propanil and 400 g.a.i./ha MCPA was applied at the stage of the rice tillering for the control of barnyardgrass, weeds of the family Cyperaceae and broadleaf weeds. In addition, the above weeds were removed by hand when it was necessary.

The characteristics studied are given in Table 1.

Table 1. Rice characteristics evaluated and method of measurement

Characteristic	Method of measurement
Days to heading	Days after sowing when 50% of panicles had emerged
Days to maturity	Days after sowing when physiological maturity occurred
Resistance to lodging	1-9, 1:resistant, 9:sensitive
Resistance to shattering	1-9, 1:resistant, 9:sensitive
Panicle leaf habit	1-9, 1:erect, 3:semi-erect, 5:intermediate, 7:horizontal, 9:drooping
Panicle type	1:compact, 5:intermediate, 9:open
Panicle length	Base to tip of panicle on the primary tiller (cm)
Plant height	Soil surface to tip of panicle on the primary tiller (cm)
Panicle exertion	1-9, 1:well exerted, 9: enclosed
Apiculus colour	1:yes, 9:no
Hull pubescence	1:glabrous, 5:intermediate hairs, 9:long hairs
Glumes development	1:glume<grain, 5:glume=grain, 9:glume>grain
Awning	1-9, 1:absent, 9:long and fully awned >3cm

II – Results and discussion

Differences among lines were found for all morphophysiological characteristics studied (Table 2). The seven control varieties showed relatively constant morphophysiological characteristics the three years of the experimentation (Table 2). This makes possible a comparative evaluation of the lines tested. The time to heading ranged from 60d (IR 57257-123-3-3-1) to 142d (Basmati T3-I) and the time to maturity from 109d (Dorella, Italico and 55 Upla) to 170d (Basmati 5853, Basmati 6131, Basmati T3-H and V-7917). The genetic material exploited the vegetative period of the area where the experiments were carried out and all the lines matured until November 16 (year 1997), except of Basmati T3-I that did not mature at all.

Most of the lines studied (49% in 1996, 89% in 1997 and 65% in 1998) were resistant to lodging (score 1). The majority of the lines (78% in 1996 and 1997 and 90% in 1998) were resistant to shattering (score1).

The genetic material differed in "panicle leaf habit". In 1996 the lines Faro, Nilo, Viale and Tesoro showed horizontal panicle leaf habit (score 7, 6%) while the other lines erect (score 1, 16%) and intermediate one (score 5, 78%). In 1997, 10% of the lines showed erect panicle leaf habit, 34% semi-erect (score 3), 40% intermediate, 15% horizontal and only one line (Samba) drooping panicle leaf habit (score 9). In 1998 7% of the lines showed erect panicle leaf habit, 25% semi-erect, 21% intermediate, 42% horizontal and 15% drooping panicle leaf habit.

All the lines were interesting as for the characteristic "panicle type". This characteristic covered all the range from compact (score 1) to open (score 9). In 1996 58% of the lines showed compact panicle type, 20% intermediate (score 5) and 22% open. On the contrary, 47% of the lines in 1997 and 51% in 1998 had intermediate panicle type. Great variability was found for the characteristic "panicle length" that ranged from 12 cm (Mistral) to 25 cm (79 Upla) in 1996, 11 cm (Balillone R 253) to 26 cm (Basmati 6131) in 1997 and 10 cm (SB 428, No 543) to 27 cm (95 Upla) in 1998.

The lines varied greatly in "plant height". In 1996 "plant height" ranged from 77 cm (68 A Upla) to 120 cm (Roncarolo) but the majority of the lines (66%) were shorter than 100 cm. In 1997 "plant height" ranged from 57 cm (Baixet) to 128 cm (Precoce 6). There were 57 lines (32%) with plant height lower than 81 cm and 69 lines (39%) with plant height between 81 and 100 cm. In 1998 "plant height" ranged from 58 (CI 1992K15) to 155 cm (Bombon). Only 6 lines (8%) were short, with plant height lower than 81 cm. Also there were 28 lines (39%) with plant height lower than 100 cm that is considered satisfactory for a breeding programme.

In 1996 only the lines Vialone 190, M6, Radon, Faro, Panda, Nilo, Rubidio, 91 Upla, 117 Upla and 2 Upla had no desirable panicle exertion (enclosed panicle, score 9) while the other lines (87%) showed well exerted panicles (score 1). All the lines in 1997 and the majority of them in 1998 (89%) had well exerted panicles. This means that the genetic material studied was very interesting and could be used in a breeding programme.

The majority of the lines (91% in 1996, 80% in 1997 and 81% in 1998) did not have apiculus color (score 9). The characteristic "hull pubescence" differed among the lines, but in majority of them (57% in 1996, 79% in 1997 and 71% in 1998) was intermediate (score 5). Glabrous (score 1) were the 40%, 14% and 21% of the lines in 1996, 1997 and 1998, respectively. Only 3% of the lines in 1996, 7% in 1997 and 8% in 1998 had long hairs (score 9).

All the lines studied the three years had glumes less than grain (score 1). There was less variability for the characteristic "awning". In 1996 only the line 79 Upla had awn lower than 1 cm (score 5) and the lines 77 Upla and 2 Upla greater than 3 cm (score 9) while the other lines had no awn (score 1). In 1997 most of the lines (85%) had no awn, 8% were partly awned (score 3) and 3% had awn lower than 1 cm (score 5). The awn was between 1 and 3 cm (score 7) in the line Carnaroli (No 58) and greater than 3cm in the line Lomellino. In 1998 most of the lines (90%) had no awn and 4% were partly awned. In the line Bluebonnet the awn was lower than 1 cm, in Goonarah between 1 and 3 cm and in lines YRL-196 and Bombilla greater than 3 cm.

In conclusion, the lines studied showed great variability for the most characteristics. Thus, the genetic material was very interesting and could be exploited in breeding programmes.

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Table 2. Mean values of various morphophysiological characteristics for 334 rice lines and seven control varieties tested in 1996, 1997 and 1998

Line	1	2	3	4	5	6	7	8	9	10	11	12	13
	1996												
BALDO 363	82	130	5	1	5	5	15	103	1	9	5	5	1
KORAL	78	129	1	1	5	1	20	103	1	9	5	5	1
ARIETE	88	131	1	1	5	1	16	95	1	9	5	1	1
LOTO	75	126	3	1	5	1	19	88	1	9	5	5	1
SENIA	99	143	3	1	5	1	15	100	1	1	5	5	1
THAIBONNET	100	145	1	3	1	9	22	93	1	9	1	5	1
CIGALON	90	134	1	1	5	1	14	96	1	9	5	5	1
AGOSTANO	71	112	3	1	5	1	18	110	1	9	5	5	1
ROSA MARCHETTI	73	130	7	1	5	1	14	118	1	9	1	5	1
RONCAROLO	90	141	3	1	5	1	15	120	1	9	5	1	1
VIALONE 190	78	130	3	1	5	1	15	105	9	9	3	1	1
OLCENENGO	82	134	5	1	5	1	16	112	1	9	5	5	1
ROMA	85	130	9	1	5	1	16	105	1	9	5	5	1
SEZIA	95	140	3	1	5	5	20	103	1	9	1	5	1
COLOSSO	88	132	9	1	5	1	20	110	1	9	5	5	1
MONTICELLI	80	127	3	1	5	1	13	105	1	9	5	5	1
RIZZOTTO 51/1	88	134	7	1	5	1	18	106	1	9	5	5	1
M 6	77	125	3	1	5	1	15	98	9	9	5	5	1
VIALONE NANO	90	140	3	1	5	1	13	98	1	9	5	1	1
BALILLA	89	136	3	1	5	1	13	97	1	9	5	5	1
GIOVANNI MARCHETTI	79	128	3	1	5	1	13	105	1	9	5	5	1
SAN DAMIANO O1	75	122	5	1	5	1	15	112	1	9	5	1	1
ROMEO	81	131	1	1	5	5	19	104	1	9	5	1	1
EUROPA	90	132	7	1	5	1	16	105	1	9	5	5	1
VOLANO	74	121	3	1	5	1	13	112	1	9	5	1	1
MISTRAL	77	125	3	1	5	1	12	98	1	9	5	1	1
TITANIO	70	115	3	1	5	1	15	82	1	9	5	5	1
TORIO	83	138	3	1	5	1	14	80	1	1	5	5	1
RADON	95	140	3	1	5	1	14	110	9	9	5	5	1
VENERIA	76	128	5	1	5	1	15	92	1	9	5	5	1
ELVO	80	130	1	1	5	1	13	88	1	1	5	1	1
SERENO	69	113	1	1	5	1	13	82	1	1	5	5	1
ALPE	82	128	1	1	5	1	14	93	1	9	1	1	1
LAGO	78	131	1	1	5	1	15	90	1	9	5	5	1
ELBA	78	131	3	1	5	1	17	99	1	9	1	1	1
CERVO	76	129	9	1	5	1	16	97	1	9	5	5	1
GITANO	74	121	1	1	5	1	15	90	1	9	5	5	1
BARAGGIA	68	110	1	1	5	1	18	85	1	9	5	9	1
DORELLA	67	109	1	3	1	9	18	92	1	9	1	1	1
ZENA	77	129	1	1	1	9	20	97	1	9	1	1	1
FARO	83	139	1	1	7	1	16	102	9	9	1	5	1
GRALDO	78	125	1	3	5	9	15	105	1	1	1	5	1
SELENIO	80	130	1	1	5	1	13	85	1	9	9	5	1
DRAGO	77	125	1	1	5	1	15	96	1	9	5	5	1
ASSO	78	127	1	1	5	1	14	88	1	9	5	5	1
GIADA	74	121	5	3	5	9	20	97	1	9	1	1	1
TARRISO	70	120	3	3	1	5	15	109	1	1	1	5	1
DIANA	69	118	3	1	5	1	14	93	1	1	5	5	1
PANDA	78	129	3	1	1	9	19	111	9	9	1	1	1
TICINO	68	120	5	3	1	9	18	105	1	9	1	5	1
MARTA	70	121	3	1	5	5	17	112	1	9	1	5	1
ALBA	72	131	1	1	5	1	16	100	1	9	5	5	1
MIARA	75	113	1	1	1	5	16	83	1	9	1	1	1
NILO	73	122	1	1	7	1	14	92	9	9	5	1	1
VIALE	75	125	1	1	7	5	16	92	1	1	9	1	1
TESORO	81	132	3	1	7	1	16	94	1	9	5	5	1
ZENITH	80	135	3	1	5	5	14	93	1	9	1	1	1
ITALICO	62	109	7	1	5	1	12	111	1	9	5	5	1
EUROSE	71	120	1	3	5	1	18	94	1	9	1	5	1
RUBIDIO	81	132	5	1	5	1	18	116	9	9	5	5	1
RIO	82	136	3	3	5	1	14	102	1	9	5	5	1
68 A UPLA	70	118	1	1	1	9	16	77	1	9	5	5	1
7 UPLA	85	137	1	1	5	1	15	99	1	9	5	5	1
65 UPLA	75	119	1	1	5	5	15	82	1	9	5	5	1
70 UPLA	84	134	5	1	1	5	16	98	1	9	1	5	1
64 UPLA	70	111	1	3	5	9	19	91	1	9	1	5	1
66 UPLA	81	129	1	3	5	5	15	79	1	9	1	1	1

Line	1	2	3	4	5	6	7	8	9	10	11	12	13
79 UPLA	95	165	1	1	5	9	25	93	1	9	1	1	5
91 UPLA	97	152	3	1	1	9	20	95	9	9	1	1	1
62 UPLA	71	118	1	3	1	5	20	81	1	9	1	1	1
63 UPLA	74	121	1	3	1	9	21	92	1	9	1	5	1
61 UPLA	78	123	1	3	5	5	16	88	1	9	5	5	1
77 UPLA	91	143	1	1	5	9	18	97	1	9	1	5	9
75 UPLA	90	146	1	1	5	5	19	92	1	9	1	5	1
72 UPLA	88	141	1	1	5	1	17	81	1	9	5	5	1
55 UPLA	65	109	1	3	5	5	17	80	1	9	5	5	1
80 UPLA	80	132	1	1	5	9	16	90	1	9	1	5	1
13 UPLA	78	130	1	3	5	9	22	95	1	9	1	1	1
104 UPLA	91	146	3	1	5	5	18	107	1	9	5	5	1
14 UPLA	80	132	1	3	5	9	20	90	1	9	5	5	1
117 UPLA	90	143	3	1	5	1	20	90	9	9	1	5	1
2 UPLA	81	132	1	1	5	9	17	92	9	9	1	5	9
32 UPLA	87	135	1	3	1	9	14	92	1	9	1	1	1
ONDA	80	133	9	1	5	1	18	118	1	9	5	5	1
VELA	72	121	1	1	5	1	15	92	1	9	1	1	1
GHIBLI	65	110	1	3	1	9	17	88	1	9	1	5	1
1997													
BALDO 363	78	127	1	1	3	9	20	106	1	9	5	1	1
KORAL	77	127	1	1	3	9	18	104	1	9	5	1	1
ARIETE	78	129	1	1	5	1	15	86	1	9	5	1	1
LOTO	72	122	1	1	7	1	12	73	1	9	5	1	1
SENIA	84	132	1	1	3	9	15	89	1	9	5	1	1
THAIBONNET	87	147	1	1	1	5	19	72	1	9	1	1	1
CIGALON	69	124	1	1	5	5	12	80	1	9	5	1	1
3C N5	73	124	9	1	7	5	17	119	1	1	5	1	1
IAC 435	85	145	1	9	5	9	18	98	1	9	1	1	1
IAC 26	90	149	1	1	5	9	15	116	1	9	5	1	1
IR 12-178-2-3	83	138	1	1	3	9	20	125	1	9	5	1	1
IR 747-B-2-6-3	92	147	1	9	1	9	20	76	1	9	5	1	1
ALLORIO	68	119	9	9	7	5	19	122	1	9	5	1	1
PIERROT	74	127	9	1	7	5	22	117	1	1	5	1	1
BALILLONE R 253	84	138	1	1	3	9	11	100	1	9	5	1	1
PRECOCE ROSSI	78	127	1	1	7	9	18	114	1	9	5	1	1
RAZZA 77	76	128	1	1	7	5	19	114	1	9	5	1	3
R 271	83	138	1	1	3	5	18	93	1	9	5	1	1
ARBORIO PRECOCE	74	126	1	1	7	5	16	97	1	1	5	1	1
LA FERLA	83	133	1	1	3	9	13	107	1	1	5	1	1
ICE	80	130	1	1	3	5	21	115	1	9	5	1	1
REDI	83	133	1	1	3	9	18	96	1	1	5	1	1
RIBE 700	81	131	1	1	3	9	17	102	1	1	5	1	1
RIBE 253	81	131	1	1	5	1	14	97	1	1	5	1	3
CARNAROLI	83	134	1	1	3	9	20	105	1	1	5	1	7
ITALPATNA 48	84	135	1	1	3	9	22	92	1	9	1	1	1
PADANO	85	136	1	1	3	1	13	81	1	9	5	1	1
ANSEATICO	86	137	1	1	3	9	20	91	1	9	1	1	1
BONNI	75	124	1	1	7	5	17	95	1	9	5	1	1
GRITNA	73	123	1	1	5	5	18	100	1	9	1	1	1
ARGO	82	131	1	1	3	5	15	94	1	1	5	1	3
LIDO	78	126	1	1	3	5	15	85	1	9	5	1	1
PIEMONTE	80	128	1	1	3	1	14	82	1	1	5	1	1
LOMELLINO	73	122	1	1	5	5	14	84	1	1	9	1	9
STRELLA	79	128	1	1	5	9	12	104	1	9	5	1	1
NIBBIO	76	125	1	1	5	1	13	77	1	9	5	1	1
MIDA	85	136	1	1	3	1	16	85	1	9	5	1	1
PERLA	77	127	1	1	1	5	18	84	1	9	5	1	1
PREVER	78	128	1	1	5	5	17	93	1	1	5	1	1
RONCOLO	82	132	1	1	5	5	13	83	1	1	5	1	1
BURMA	89	139	1	9	5	9	18	80	1	1	1	1	3
LORD	83	133	1	1	7	5	18	91	1	9	1	1	1
CARIOCA	76	128	1	1	7	9	17	105	1	9	5	1	1
SMERALDO	78	129	1	1	3	1	15	84	1	9	5	1	1
SILLA	75	124	1	1	7	5	17	102	1	9	5	1	1
BORA	80	129	1	1	5	5	18	109	1	1	5	1	1
PETRONIO	80	131	1	1	3	5	14	93	1	9	9	1	1
SAMBA	75	125	1	1	9	5	18	99	1	9	5	1	1
BLUE FLORENCE	84	139	1	1	5	5	17	91	1	9	5	1	1
MAKEDONIA	82	138	1	1	3	5	16	91	1	9	5	1	1

Line	1	2	3	4	5	6	7	8	9	10	11	12	13
DION	85	140	1	1	3	5	15	93	1	9	5	1	1
IR 52341-60-1-2-1	81	131	1	1	5	5	19	101	1	9	5	1	1
IR 53970-21-2-3-2	83	135	1	1	5	9	17	98	1	9	5	1	1
IR 56453-184-2-1-2	62	119	9	1	7	5	17	93	1	9	1	1	1
IR 57257-123-3-3-1	60	120	9	1	5	5	17	103	1	9	9	1	1
IR 57287-99-1-3	66	119	1	9	1	5	17	71	1	9	5	1	1
IR 57301-24-1-2	66	119	1	9	1	5	19	75	1	1	5	1	1
IR 47684-5-1-B	99	154	1	9	3	9	22	76	1	9	5	1	1
IR 53236-275-1	94	145	1	1	3	9	20	74	1	9	5	1	1
CAN 108-8-42-24-2B	104	154	1	9	3	5	22	75	1	9	5	1	1
CAN 4130	98	148	1	9	5	9	23	80	1	9	5	1	1
AUS 196	103	155	1	9	5	9	23	71	1	9	5	1	1
CAN 4173	89	141	1	9	3	9	24	75	1	9	5	1	1
N-136	96	151	1	9	5	9	23	74	1	9	5	1	1
SUDA	98	153	1	9	5	9	21	69	1	9	5	1	1
BONNET BELLE	90	145	1	9	3	9	23	69	1	9	5	1	1
MEDUSA	94	149	1	9	5	9	21	70	1	9	5	1	1
ORIONE	111	163	1	1	5	9	22	96	1	9	5	1	1
ARIANA	110	160	1	9	5	9	23	95	1	1	5	1	1
TAICHUNG-65	83	135	1	9	3	5	18	92	1	1	5	1	1
BELLEVILLE	83	135	1	9	3	5	15	93	1	9	5	1	1
BRAZOS	92	147	1	9	3	9	19	115	1	9	1	1	1
CENTURY PATNA	90	145	1	1	5	5	17	114	1	9	5	1	1
DAWN-CI-9534	90	145	9	9	5	9	20	111	1	1	5	1	1
HARRA	85	140	1	1	1	5	17	81	1	9	1	1	1
PELDE (YRL-20)	94	149	1	9	5	9	21	93	1	9	5	1	1
CAN-6159	86	141	1	1	1	5	20	77	1	9	1	1	1
BAIXET	82	139	1	1	1	5	13	57	1	9	5	1	3
BOMBA	89	143	1	1	5	1	19	101	1	9	5	1	5
CLOT	79	130	1	1	5	5	13	71	1	9	5	1	1
LEDA	84	135	1	1	3	1	12	71	1	9	5	1	1
MARENY	77	127	1	1	5	5	14	77	1	9	5	1	1
MARJAL	84	134	1	1	1	1	14	65	1	9	5	1	1
ULLAL	84	134	1	1	3	1	15	65	1	9	5	1	1
CT-18	91	146	1	9	3	5	22	76	1	9	5	1	3
CT-52	81	140	1	1	5	9	19	74	1	9	1	1	1
BRAVO	76	126	1	1	5	1	14	87	1	9	5	1	1
FLIPPER	77	127	1	1	5	1	15	82	1	9	5	1	1
SAVIO	75	125	1	1	5	1	15	84	1	9	1	1	1
KATY	103	153	1	1	5	5	18	82	1	9	1	1	3
S-201(THAIPERLA)	84	141	1	1	3	5	16	78	1	9	1	1	1
"25" ARISTADO	70	125	9	1	7	5	16	103	1	9	9	1	1
BASMATI 5853	115	170	1	9	5	9	25	108	1	9	5	1	3
BASMATI 6129	110	165	1	9	5	9	25	114	1	9	5	1	3
BASMATI 6131	115	170	1	9	5	9	26	104	1	9	5	1	3
BASMATI C.621	84	146	9	9	3	9	24	105	1	1	5	1	5
BASMATI C.622	103	158	1	1	5	9	18	107	1	1	5	1	5
BASMATI T3-H	114	170	1	1	5	9	19	110	1	9	5	1	1
BASMATI T3-I	142	No maturity				5		16	108	1		1	3
BEIR<O	65	118	9	1	7	9	20	102	1	1	5	1	1
BELAM	83	134	1	1	3	9	21	91	1	9	5	1	1
BRASILEIRO	105	158	1	1	5	5	20	112	1	9	1	1	1
FER_NIO	86	137	1	1	5	5	18	104	1	1	5	1	1
IRRAL	73	123	1	1	5	1	15	87	1	1	9	1	1
JUDAS	88	139	1	1	7	5	14	103	1	1	5	1	5
LEZ'RIA	76	126	9	1	7	9	20	117	1	1	9	1	1
LUSITO	74	124	9	1	3	5	18	93	1	1	9	1	1
MAIORAL	89	149	9	1	5	9	21	116	1	9	5	1	1
ESCAR	75	126	9	9	5	5	19	114	1	1	5	1	5
PRECOCE 6	73	122	9	1	7	9	18	128	1	9	5	1	1
PRECOCE Y 5239	87	137	9	1	3	5	18	107	1	9	9	1	1
REAL	82	132	9	1	3	9	20	126	1	9	5	1	1
REG1NA	72	123	9	1	3	5	17	122	1	9	1	1	1
SUWEON 279	108	158	1	1	1	9	20	72	1	9	5	1	1
SUWEON 281	97	147	1	1	1	9	21	80	1	9	5	1	1
TONGIL	94	144	1	9	1	9	19	76	1	9	5	1	1
BALILLA GRANA GROSSA	79	128	1	1	3	5	14	80	1	9	5	1	1
MARATELLI	73	122	1	1	3	5	15	109	1	9	5	1	1
SAN ANDREA	84	135	1	1	3	9	17	108	1	9	5	1	3
ALPHA	85	135	1	1	3	5	14	76	1	9	5	1	1

Line	1	2	3	4	5	6	7	8	9	10	11	12	13
GIGANTE VERCELLI	86	136	1	1	5	9	21	110	1	1	5	1	1
R.B. GAMMA	83	133	1	1	3	9	18	90	1	9	5	1	1
BAJANG X ALLORIO 199/65	82	132	1	1	7	9	21	115	1	9	5	1	1
RIBE JAUNE	73	123	1	1	5	5	16	105	1	9	1	1	1
SENATORE NOVELLI	80	130	1	1	3	9	18	111	1	1	5	1	1
M 1003	74	128	1	1	5	5	14	95	1	9	5	1	1
BISER I	77	127	1	1	5	9	19	100	1	9	5	1	1
USPEH	79	129	1	1	5	5	14	80	1	9	5	1	1
MILEV 20	76	128	1	1	5	5	17	98	1	9	9	1	1
DA SOUDAN B	72	124	9	9	7	5	15	89	1	9	5	1	1
VARY LAVA B	86	136	1	1	5	9	20	116	1	9	5	1	3
VARY LAVA 542	78	129	1	1	5	9	20	96	1	1	5	1	3
VICTORIA	75	139	9	1	3	5	16	85	1	9	5	1	1
CINIA 40	83	133	1	1	5	9	20	95	1	9	5	1	3
CINIA 115	84	134	1	1	5	9	19	77	1	9	1	1	1
CT 23	84	134	1	1	3	9	19	89	1	9	5	1	1
CT 36	84	135	1	1	3	5	17	57	1	9	5	1	1
CT 50	78	129	1	1	5	9	17	72	1	9	5	1	3
CT 58	78	129	1	1	5	5	17	73	1	9	5	1	1
CT 53	83	133	1	1	5	9	20	73	1	9	5	1	1
CNA 4081	91	143	1	9	1	5	23	70	1	9	5	1	3
VARIETA 16	76	127	1	1	3	5	13	72	1	1	5	1	1
RPC 12	73	123	1	1	3	1	14	70	1	9	5	1	1
ZHEN SHANG 97	78	129	1	9	3	9	19	70	1	9	5	1	1
YRM 6-2	83	133	1	1	3	5	16	80	1	9	1	1	1
YRM 25	84	134	1	1	3	9	17	74	1	1	5	1	1
GARDE SADRI 79015	80	130	1	1	3	9	16	88	1	9	5	1	1
CALENDAL	78	128	1	1	5	9	21	108	1	9	5	1	1
MARATHON	77	127	1	1	5	5	16	94	1	9	5	1	1
DELTA	70	121	1	1	7	5	17	96	1	9	5	1	1
CIGALON MINCE MUTIQUE 49	83	133	1	1	5	9	18	98	1	9	5	1	1
CIGALON TALLIFORE 43	72	127	1	1	5	1	14	71	1	9	5	1	1
BALILLA VITREUX 1	84	132	1	1	1	5	12	68	1	9	5	1	1
CESARIOT	71	121	1	1	7	5	18	87	1	9	5	1	1
CESARIOT EPSILON GAMMA	75	125	1	1	3	5	17	98	1	9	5	1	1
ALLORIO LAMBDA	72	122	1	1	3	5	15	88	1	9	5	1	1
STIRPE Y FEUILLAGE VIOLET	84	138	1	1	7	9	18	97	1	1	9	1	1
ARLESIEUNNE	78	128	1	1	5	5	14	95	1	9	9	1	1
M 164	78	128	1	1	5	9	20	104	1	9	5	1	1
M 10	76	126	1	1	5	5	17	97	1	9	5	1	1
ARLATAN	72	123	1	1	7	5	20	92	1	9	9	1	1
CRISTAL	78	128	1	1	5	5	16	78	1	9	5	1	1
FANNY	72	122	1	1	5	5	12	60	1	9	5	1	1
DELTAVINGT A	75	125	1	1	7	5	18	98	1	9	5	1	5
CICADELTA R	74	124	1	1	5	5	15	84	1	9	5	1	1
VARLAVINGT B	78	128	1	1	5	9	19	105	1	9	5	1	1
ALINANO C	86	136	1	9	5	9	19	99	1	9	5	1	1
ARLASKI A	72	121	1	1	7	5	16	78	1	9	5	1	1
IRANIRCEKA	69	122	1	1	7	5	19	86	1	1	5	1	1
MEJANES 2	74	126	1	9	3	9	20	91	1	9	5	1	1
DOPANA	80	132	1	1	7	5	17	76	1	9	1	1	1
GUADAMAR	79	131	1	1	7	5	17	84	1	9	5	1	1
IR42015-88-3-2-2	90	145	1	9	1	9	21	74	1	9	5	1	3
IR45907-160-3-2-2	79	131	1	9	1	9	21	69	1	9	5	1	1
IR52287-153-1-1-2	98	148	1	1	3	9	20	73	1	9	5	1	1
IR53970-9-2-2-1	92	144	1	9	1	9	19	64	1	9	5	1	1
LLC-101	98	148	1	1	3	9	18	67	1	9	1	1	1
LLC-303	100	150	1	1	3	5	19	73	1	9	1	1	1
LLC-404	82	151	1	1	5	5	15	80	1	9	5	1	1
OR165-86-12	87	133	1	9	1	9	18	79	1	9	5	1	1
PUNTAL	96	138	1	9	3	9	18	82	1	9	1	1	1
V-7917	112	170	1	9	1	9	20	80	1	9	1	1	1
VETA	79	129	1	1	7	5	18	82	1	9	5	1	1
1998													
BALDO 363	76	130	1	1	7	5	20	114	1	9	5	1	1
KORAL	77	126	1	1	7	5	19	114	1	9	5	1	1
ARIETE	72	127	9	1	7	5	19	114	1	9	5	1	1
LOTO	68	126	1	1	7	1	16	83	1	9	5	1	1
SENIA	80	140	1	1	5	5	14	86	1	9	9	1	1
THAIBONNET	89	148	1	9	3	5	25	94	1	9	1	1	1

Line	1	2	3	4	5	6	7	8	9	10	11	12	13
CIGALON	57	115	1	1	5	1	15	76	1	1	5	1	1
I CUNG PAO	81	130	9	1	7	9	23	146	1	9	5	1	1
TOPEI-WOOCO	96	145	9	1	7	9	22	134	1	9	5	1	1
IAC 32/52	96	150	9	1	7	5	23	135	1	1	1	1	1
KAO SHE SHUNG	95	149	9	1	3	9	22	95	1	9	5	1	1
NANO	84	141	1	1	1	1	19	65	9	9	5	1	1
RUBINO	80	130	1	1	5	9	16	112	1	1	5	1	1
PIERINA MARCHETTI	79	130	1	1	5	5	17	112	1	1	5	1	1
ARMONIA	85	141	1	9	3	5	25	101	1	1	1	1	1
GOLFO	97	148	1	1	3	9	25	86	9	9	1	1	1
PLUS	80	130	1	1	3	5	20	108	1	1	1	1	1
RIVA	76	126	1	1	7	5	18	104	1	9	1	1	1
95 UPLA	89	151	1	1	7	9	27	89	1	9	5	1	1
84 UPLA	90	143	1	1	5	9	19	96	1	9	1	1	1
8 UPLA	92	145	1	1	5	5	23	85	1	9	1	1	3
CI 1992K11	86	145	1	1	3	5	22	87	1	9	5	1	1
CI 1992K15	88	147	1	1	1	5	21	58	1	9	5	1	1
KOSHIHIKARI	83	143	9	1	9	5	20	120	1	9	9	1	1
SIDEF	99	147	1	1	7	9	20	112	1	9	1	1	1
AMAROO	102	155	1	1	5	9	20	81	1	9	5	1	1
BARU	87	142	1	9	7	9	21	102	1	9	1	1	